IMMOBILIZATION AND TRANSLOCATION OF NILGAI IN INDIA USING CARFENTANIL[1]

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This paper describes the capture and translocation, over approximately 7 km distance, of 14 nilgai (*Boselaphus tragocamelus*) at Bhatinda, Punjab. A mixture of carfentanil (2-5 mg/animal) and acepromazine (20-50 mg/animal) was used for drug immobilization, mainly conducted at night using a powerful spotlight from a jeep. Carfentanil was reversed using either naloxone (25-66 mg/mg carfentanil) or diprenorphine (10 mg/mg carfentanil). Mean induction time was 4.1 min. and reversal time 6.6 min. The drug mixture used was useful for immobilizing nilgai, primarily due to the short induction time. Standard body measurements of immobilized animals are reported.

Introduction

A population of approximately 50 nilgai or "bluebull" (*Boselaphus tragocamelus*) were enclosed by a fence in a 450 ha disused ammunition depot at Bhatinda Cantonment, Punjab. The commander of the depot wanted to move the nilgai population to a new depot 7 km from the old site. For this task the Wildlife Institute of India (WII) was asked for technical advice and assistance during April, 1985.

The topography in the enclosure was gently rolling to flat and covered with scattered scrub jungle, with a grass understory. This made it possible to gain access to most of the area by 4×4 vehicle.

The capture method selected was chemical immobilization. No published data were available for chemical immobilization of nilgai in the wild. We chose the new experimental drug carfentanil based on reports from African antelope (de Vos 1978) of relatively short mean induction times for impala (*Aepyceros melampus*) of 4.9 min. (n=14), springbok (*Antidorcas marsupialis*) of 4.9 min. (n=5), and Greater Kudu (*Tragelaphus strepsiceros*) of 4.5 min. (n=2). Induction times of less than 5 min. were also reported for cervids such as elk (*Cervus elaphus*) (Meuleman *et al.* 1984), moose (*Alces alces*) (Franzmann *et al.* 1984, Seal *et al.* 1985) and mule deer (*Odocoileus hemionus*) (Jessup *et al.* 1984) in North America.

This paper reports our experiences using a carfentanil/acetylpromazine mixture to immobilize nilgai, approaching animals for darting with spotlights, and use of naloxone and diprenorphine as carfentanil antagonists. We report basic measurements from captured nilgai.

Material and Methods

Carfentanil is a piperadine derivative, with morphine-like qualities but of higher potency. In relation to the widely used immobilizing drug etorphine hydrochloride (M 99, Lemmon Co., Sellersville, PA, USA; Immobilon, Rickett and Colman, Hull, U.K.), about half the dosage of carfentanil is required (Franzmann *et al.* 1984). The common etorphine antagonists, diprenorphine hydrochloride (M50-50, Lemmon Co., Sellersville, PA, USA; Revi-

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von, Rickett and Colman, Hull, U.K.) and naloxone hydrochloride (Naloxone — chemical grade, Sigma Chemical, St. Louis MO, USA; Narcan, Endo Laboratories, Garden City, NY, USA) have been used to reverse the effects of carfentanil. Jessup *et al.* (1984) reported ideal reversal dosages for mule deer as 10 mg diprenorphine or 50 mg naloxone for each mg carfentanil administered. They also reported using acetylpromazine maleate (Acepromazine, Ayerst Laboratories Inc. NY, USA) as an adjunct tranquilliser to potentiate and balance the narcotic effect. We utilized both diprenorphine and naloxone as antagonist drugs and acetylpromazine as an adjunct tranquillizer.

Carfentanil was supplied in 1 ml ampules, containing 10 mg of drug. This concentration was greater than needed and we prepared a mixture containing 1 mg carfentanil and 10 mg acetylpromazine/ml. The drug combination was administered using 2, 3 and 4 ml projectile darts fired from a powder-charged gun (Distinject, Peter Ott Co., Basel, Switzerland) using the appropriate charges based upon projectile size and distance fired.

An open jeep was used to approach the animals and fire the dart. Another jeep and an enclosed 4×4 vehicle were used as support vehicles to assist in searching for immobilized animals. This mode of approach worked for the first nilgai, but thereafter the animals became shy and we had to resort to use of hand-held spotlights (12 volts; 200,000 to 300,000 candle power) to dazzle and shoot the animals at night, from the vehicle. This worked successfully for several nights but then the nilgai again became wary and difficult to approach. We ceased the operation when spotlighting was no longer successful.

Once an animal was immobilized we checked vital signs (heart rate, respiratory rate, body temperature), checked for injuries, gave an injection of tetracycline hydrochloride (Liquamycin- LA, Pfizer & Co, NY, USA), removed the dart, blindfolded the animal and called in the translocating crew consisting of a detachment of army personnel and a flat bed trunk padded with straw covered by a tarpaulin. The nilgai's feet were tied together and then the animal was loaded onto the truck with the aid of two 8 cm wide 5 m lengths of webbing used as a sling; one at the flank, the other around the chest.

Measurements were made of body length with tail, tail length, body length without tail, shoulder height, chest girth and hind foot length from all animals captured. Horn length and circumference were recorded from male nilgai. Estimates of body weight were made, based on earlier work on nilgai.

The immobilized animals were transported via road directly to the new ammunition depot, 7 km from capture site. A veterinarian accompanied each animal to monitor vital signs and to administer the antagonist upon arrival. At the new site the animal was lowered to the ground, its legs untied, the blindfold removed and the antagonist given on the basis of total mg of carfentanil used for immobilization.

Results

Fourteen nilgai (9 males, 5 females) were translocated to the new site. Only the first animal was captured during daytime, the remainder were captured by the use of spotlights at night, all by darts fired from a jeep. Immobilization dosages/animal (Table 1) ranged from 2 to 5 mg carfentanil (mean=3.2 mg) and 20 to 50 mg acetylpromazine (mean = 32.6 mg). Immobilization dosages/kg body weight (BW) ranged from 0.006 to 0.014 mg/kg. (mean=0.011). Induction times ranged from 3 to 6 min. (mean=4.1) (Table 1).

TABLE 1

DOSAGES AND RESPONSE OF NILGAI (*Boselaphus tragocamelus*) IMMOBILIZED WITH CARFENTANIL/ACETYLPROMAZINE AT BHATINDA, PUNJAB, INDIA (APRIL, 1985)

Animal Number	Sex	Carfentanil mg/animal	Acepromazine mg/animal	Carfentanil mg/kg EW	Induction time (min.)	Antagonist naloxone mg/animal IM	Antagonist naloxone mg/animal IV	Antagonist diprenorphine mg/animal IM	Antagonist diprenorphine mg/animal IV	Antagonist mg/mg-carfentanil	Reversal time (min.)	Body temp. (F)	Respiration rate/min.	Comments
1	M	2	20	.006	4.0	110				55	4	100	12	translocated
2	M	2	20+20	.006	3.5		100			50	–	100	20	died (bloat)
3	M	2+1+1	20+10+10	.011	Unk	200				50	15	98	12	translocated
4	F	3	30	.013	3.5		100			33	5	100		translocated
5	F	3	30	.013	6.0	100	100			66	12	101		translocated
6	M	3+1	30+10	.011	5.0		100			25	5	100		translocated
7	M	3	30	.009	5.0		100			33	5	101.8		translocated
8	F	3	30	.013	3.0		100			33	4	99		translocated
9	M	3	30	.009	Unknown		100			33	10	104		translocated
10	F	3	30	.013	3.5		100			33	5	100.4		translocated
11	M	3+2	30+20	.014	4.0		200			48	–	99	8–2	died (resp. failure)
12	M	3+1	30+10	.011	4.0		100			33	5	–		translocated
13	F	3	30+10	.013	3.5			10	20	10	5	99		translocated
14	M	3	30+20	.009	Unknown			10	20	10	5	100		translocated
Mean		3.2	32.6	.011	4.1	Total IV, IM 126		Total IV, IM 30		41 naloxone 10 diprenorphine	6.6	100.2		

a. Based upon estimated weight of 225 kg for females and 350 kg for males.

Only one animal (No. 9) had a rise in body temperature (40°C) that was potentially problematic, but the animal was translocated and did recover. Respiratory rates were recorded for only the first three animals, but were monitored thereafter for only one animal varying significantly from the range of 12 to 20. That animal (No. 11) had a drop in respiratory rate to 2/min. and died soon thereafter. This occurred during translocation and the animal could not be reversed with the antagonist drug in time.

Two mortalities occurred during translocation; one animal died due to bloat and subsequent toxic shock and heart failure, the other due to respiratory failure. The animal that bloated was a large male that, in retrospect, was thought to have been slightly under-dosed (2 mg carfentanil, 40 mg acetylpromazine). He struggled during transport and had to be physically subdued making proper positioning on the sternum difficult to maintain. Moreover, the driver of the truck could not find his way out of the depot and precious time (45 min.) was added to the transport time. This proved too long and the bloat could not be controlled. The animal died a few minutes after arrival at the release site. A subsequent post-mortem examination substantiated the bloat/shock syndrome.

The second translocation mortality was listed as respiratory failure and, in retrospect, the animal was thought to have been overdosed (5 mg carfentanil, 50 mg acetylpromazine). The animal's respiratory rate prior to loading was 8/min. and during transport dropped to 2/min. Reviving the animal during transport was not possible and an attempt was made to get to the new site as soon as possible. On arrival the animal had ceased breathing and a large dose of the antagonist naloxone (200 mg) was given intravenous but the animal did not recover.

During the capture operation, a few animals that we darted were not found because of the heavy cover and/or the animal was lost when the group it was in scattered in different directions. These factors were complicated by the fact that all animals except one were captured at night. The exact number that escaped after being darted was unknown because it was not possible to know for sure if an animal was darted. Nevertheless, we found two animals dead at the captured site, both of which had been darted. One was a young female that we were fairly sure was darted but could not be located. The other was a larger female that had a dart still protruding from the dorsal neck region. Apparently that animal was hit by a dart meant for another animal in the herd. Neither, of course, received the antagonist. Both animals were in a state of putrefaction and determining the cause of death by necropsy was not feasible.

Immobilized nilgai assumed a position of lateral recumbency and tended to kick and struggle vigorously when attempts were made to place them in sternal recumbency. It was nearly impossible for the animals to remain in sternal recumbency unaided.

We captured a majority of males because they were more approachable than females, particularly females with yearlings at their side. Female groups also were larger which often made approaches more difficult as one animal in a group could precipitate flight of all. Males seemed less concerned at approach, and were often found as singles or in pairs. We could have perhaps moved more males, but much time was spent trying to translocate females.

Measurements of nine male nilgai for body length with tail ranged from 225 to 270 cm (mean = 248.6 cm). Tail length ranged from 45 to 73 cm (mean = 51.6 cm); body length without tail ranged from 177 to 236 cm

(mean = 200.3 cm); height at shoulder ranged from 130 to 150 cm (mean = 173.8 cm, n = 8); chest girth ranged from 132 to 176 (mean = 157 cm); hind foot ranged from 52 to 57 cm (mean = 55.4 cm, n = 8); horn length ranged from 16 to 23.5 cm (mean = 20.4 cm, n = 8); and horn circumference ranged from 12 to 18 cm (mean = 16 cm, n = 8) (Table 2).

Measurements of five female nilgai for body length with tail ranged from 188 to 236 cm (mean = 219.6 cm); tail length ranged from 44 to 52 cm (mean = 47.8 cm); body length without tail ranged from 143 to 192 cm (mean = 171.8 cm); shoulder height ranged from 100 to 130 cm (mean = 116.8 cm), chest girth ranged from 106 to 132 cm (mean = 126 cm); and hind foot length ranged from 40 to 53 cm (mean = 47.4 cm) (Table 2).

Discussion

The carfentanil/acetylpromazine drug mixture was useful for immobilizing nilgai, primarily due to the short induction times (mean = 4.1 min.). This was particularly important in this operation because capture was primarily done at night, making follow-up of darted individuals more difficult. Another positive attribute of the drug was its reversibility. We were not completely pleased with the level of narcosis because the animals still struggled and kicked while down. We increased carfentanil immobilizing doses and supplemented the dose with additional carfentanil in four instances (Table 1) to attain deeper narcosis. This was successful in only one animal (No. 11), but in this case the dosage was apparently exces-

Table 2

Measurements (cm) of nilgai (*Boselaphus tragocamelus*) captured at Bhatinda, Punjab, India (April, 1985)

Animal number	Sex	Body length with tail	Tail length	Body length	Shoulder height	Chest girth	Hind foot	Horn length	Horn Circum.
1	M	225	45	180	130	153	52	22	17
2	M	258	52	236	130	146	57	17	16
3	M	270	52	218		162		18.5	17
4	F	188	45	143	118	132	40		
5	F	215	52	163	100	130	53		
6	M	260	73	187	148	160	56	22.5	16.8
7	M	225	48	177	134	154	54.5	23.5	18.0
8	F	229	51	178	130	132	51.0		
9	M	235	45	190	135	164	56		
10	F	236	44	192	122	130	48.6		
11	M	240	45	195	146	166	54	22	17
12	M	257	51	206	134	132	54	16	14.5
13	F	230	47	183	114	106	45		
14	M	267	53	214	150	176	60	22	12
Mean	M	248.6	51.6	200.3	173.8	157.0	55.4	20.4	16
Mean	F	219.6	47.8	171.8	116.8	126.0	47.4		

sive and the animal died. Supplemental acetylpromazine in seven animals (Table 1) did not appear to make the animals more tractable. It was difficult to minimise external disturbances (noise, activity, lights) which may have affected the level of narcosis.

Both antagonists (naloxone, diprenorphine) worked well. Only two animals were given diprenorphine (20 mg IV, 10 mg IM) and both were reversed in 5 min. In each animal, 10 mg diprenorphine was given for each mg carfentanil administered. Naloxone dosages varied from 25 to 66 mg for each mg carfentanil administered. One animal (No. 6) was renarcotized after the initial reversal. This animal was apparently underdosed (25 mg naloxone/mg carfentanil) but with an additional 100 mg naloxone IM the following day, it got up and appeared normal. It was seen for several days thereafter in apparent good health. Six nilgai received 33 mg naloxone/mg carfentanil and were reversed in from 4 to 10 min. Perhaps doses lower than this would be adequate, but with the poor response of the animal receiving 25 mg naloxone/mg carfentanil we were very close to the proper minimum dose when we administered 33 mg naloxone/mg carfentanil IV. Two animals were given naloxone antagonist IM at a rate of 50 and 55 mg/mg carfentanil. Both were successfully reversed in 15 and 4 min., respectively. Another animal received 100 mg each IM and IV of naloxone (66 mg/mg carfentanil) and reversal time was 12 min. (Table 1). The antagonist worked intravenous and intramuscular and in combination, but it was much faster when given intravenous even with a lower dosage rate.

Nightlighting to capture nilgai was successful until the animals became conditioned to flee and/or stay out of range. A possible reason for this was that the spotlight used also illuminated the surroundings, including the vehicle and shooters. An adaptation to possibly correct this would be to mount a tube on the light that would concentrate the beam and prevent spread of light in the adjacent area. The operation was also complicated by the number of vehicles and spotlights deployed at one time. However, it was necessary to have other vehicles in the area to help locate the animals after darting. Better control of their use during the approach may improve capabilities in the future.

We believe that for the most efficient use of resources, we should use vehicle approach and shoot until the animals become wary (probably after two or three nights), and when this occurs discontinue for a period of several weeks. This may not be possible in all cases, to capture the remainder of the animals in the old ammunition depot at Bhatinda it was recommended that this approach be tried.

Measurements (Table 2) were carried out to establish base-line morphometric data for free-ranging nilgai which are lacking. Unfortunately weights and blood data were not obtained but it is recommended that these be obtained on subsequent operations.

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